



Staff Report

USE INFORMATION AND AIR MONITORING RECOMMENDATION FOR THE PESTICIDAL ACTIVE INGREDIENT ALDICARB

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BACKGROUND

To fulfill the requirements of AB 1807/3219 (Food and Agricultural Code, Division 7, Chapter 3, Article 1.5), the Department of Pesticide Regulation (DPR) has previously requested that the Air Resources Board (ARB) document the airborne concentrations of the pesticide aldicarb (2-methyl-2-[methylthio]propionaldehyde *O*-methylcarbamoyloxime). This recommendation provides background and recent use information on aldicarb-containing products, and identifies how they are used.

Aldicarb (CAS: 116-06-3) is a colorless crystalline solid with a faint sulfurous odor. Aldicarb has a molecular formula of $C_7H_{14}N_2O_2S$, a molecular weight of 190.27, and a specific density of 1.195 at 25°C. It has a water solubility of 6.0 g/L at 25°C, a Henry's Constant of 1.45×10^{-9} atm·m³/mol at 20–25°C, and a vapor pressure of 3.47×10^{-5} mmHg at 25°C. Aldicarb is miscible with most organic solvents.

In soil, aldicarb is rapidly converted to aldicarb sulfoxide in the presence of oxidizing agents and microorganisms. Further oxidation to the sulfone by microorganisms occurs at a slower rate. Mineralization was more rapid in aerobic surface soils than either aerobic or anaerobic subsurface soils; aldicarb degrades rapidly in aerobic silty clay loam soils releasing carbon dioxide. Reported soil half-life ($t_{1/2}$) ranges from 7 to 70 days. In water, the reported hydrolysis half-lives range from 175 to 245 days. In plants, with the exception of cotton, aldicarb is rapidly metabolized to aldicarb sulfoxide, sulfone, and water-soluble noncarbamate compounds. Aldicarb sulfoxide is highly soluble, acts systemically on the plant, and is 10-20 times more active as a cholinesterase inhibitor than the parent compound.

The acute oral LD₅₀ of aldicarb for rats ranges from 650 to 930 µg/kg. The LC₅₀ (96 hour) of aldicarb for rainbow trout is 0.88 mg/L, and for bluegill sunfish is 1.5 mg/L. The LC₅₀ (72 hour) for bluegill sunfish is 100 µg/L. Aldicarb has entered the risk assessment process at DPR under the Birth Defect Prevention Act of 1984 (SB950) primarily because of its cholinesterase inhibition.

USE OF ALDICARB

As of March 4, 1996, there were four active registrations for products containing aldicarb, all of which are agricultural products. Aldicarb is a soil applied systemic insecticide absorbed via the roots and translocated throughout the plant, providing control of insects and nematodes. Aldicarb is formulated as either granules or flakes. The Signal Word found on these aldicarb-containing products is "Poison/Danger".

Aldicarb use for 1993, 1992 and 1991 is summarized in Table 1, showing aldicarb use by year; and in Table 2, showing aldicarb applications in Kern and Kings Counties. The agricultural use of aldicarb in the six counties listed in Table 1 accounts for 77% to 86% of the total annual aldicarb use. All the remaining 14% to 23% of the total use in California is applied agriculturally in counties not listed in Table 1. Aldicarb, due to its ability to move through porous sandy soils, is not registered for use in Humboldt and Del Norte Counties.

Table 1. Aldicarb Use by Year (Pounds of Active Ingredient)

County	1993	1992	1991
Kern	57,198	55,530	54,858
Kings	49,412	32,271	44,864
Tulare	29,194	27,975	22,364
Fresno	50,372	26,618	23,570
County Totals	188,169	144,386	147,647
<i>Percent of Total</i>	<i>79.2%</i>	<i>85.7%</i>	<i>76.6%</i>
<i>CALIFORNIA</i>			
<i>TOTAL</i>	<i>237,734</i>	<i>168,569</i>	<i>192,763</i>

The Pesticide Use Report data summarized in Table 1 show that Kern, Kings, Tulare, and Fresno Counties routinely receive the greatest applications of aldicarb. Yearly applications of aldicarb are consistently largest in Kern County followed by yearly applications in Kings and Tulare Counties. Table 2 shows monthly aldicarb use in Kern, Kings, and Fresno Counties. In 1993, annual aldicarb use in Fresno County nearly doubled when compared to previous years. Nearly all of the increase can be attributed to a three-fold increase in use during the month of April 1993 (Table 2). Because the 1994 use data is not yet available, it cannot be determined if the increased use in Fresno County during April is a trend or one-time occurrence.

Table 2. Annual aldicarb use by month for Kern, Kings, and Fresno Counties in pounds of active ingredient, during seasons of use.**-Kern County-**

Month	1993	1992	1991
March	1,634	1,915	-
April	21,022	17,518	24,992
May	8,837	12,064	4,424
June	22,441	21,196	20,790
July	1,640	2,837	4,652
August	1,144	-	-
September	479	-	-
<i>Total</i>	<i>57,198</i>	<i>55,530</i>	<i>54,858</i>

-Kings County-

Month	1993	1992	1991
March	-	934	186
April	37,834	24,154	29,375
May	8,558	3,496	8,306
June	3,050	3,687	6,922
July	-	-	75
<i>Total</i>	<i>49,442</i>	<i>32,271</i>	<i>44,864</i>

-Fresno County-

Month	1993	1992	1991
March	3	289	-
April	41,917	15,103	19,329
May	4,021	6,001	557
June	3,876	5,224	3,044
July	465	-	190
August	-	-	450
<i>Total</i>	<i>50,372</i>	<i>26,617</i>	<i>23,570</i>

Aldicarb is a soil-applied systemic insecticide, acaricide, and nematicide. Most of the aldicarb used in California is applied to cotton, primarily for the control of aphids and thrips. Additionally, aldicarb has a

putative growth enhancing effect on cotton, and for this reason many growers make routine, low-concentration applications (at about 1 lb/acre) in the spring. Table 3 summarizes the total amounts and rates of aldicarb applied to cotton in Kern and Kings Counties in 1993, during the seasons of highest use. 1991 and 1992 use patterns mirror the patterns shown in 1993. It is important to note that each year the rates of aldicarb use on cotton during the month of May changed dramatically. The rate of use doubled during the second half of the month. Each year, this change in use occurred consistently on or about the 15th of May.

Table 3. 1993 Aldicarb applications to cotton in Kern and Kings Counties during months of highest rate of use, indicating pounds of active ingredient (AI) applied, and average monthly application rates.

	May 1-15		May 16-31		June 1-15		June 16-30	
County	Lbs Used	Rate	Lbs Used	Rate	Lbs Used	Rate	Lbs Used	Rate
Kern	2,016	1.3	6,748	2.1	14,963	2.0	7,233	1.9
Kings	7,815	0.8	743	2.2	1,719	2.1	1,331	2.2

RECOMMENDATIONS

Ambient Air Monitoring.

The use patterns for aldicarb suggest that monitoring should occur over a 30- to 45-day sampling period in either Kern or Kings County. In 1993 a notable increase in aldicarb use occurred in Fresno County, indicating that county could be considered, as well, although the 1994 use data should be consulted prior to the onset of sampling. Sampling may be conducted during the month of April in Kings or Fresno Counties; alternatively, sampling may be conducted in Kern County during June. Three to five sampling sites should be selected in relatively high-population areas or in areas frequented by people. In any case, sampling sites should be located near cotton growing areas. Ambient samples should not be collected from samplers immediately adjacent to fields where aldicarb is being applied. At each site, twenty to thirty discrete 24-hour samples should be taken during the sampling period. Background samples should be collected in an area distant to aldicarb applications.

Replicate (co-located) samples are needed for five dates at each sampling location. Two co-located samplers (in addition to the primary sampler) should be run on those days. The date chosen for replicate samples should be distributed over the entire sampling period. They may, but need not be, the

same dates at every site. Field blank and spike samples should be collected at the same environmental (temperature, humidity, exposure to sunlight) and experimental (air flow rates) conditions as those occurring at the time of ambient sampling.

Monitoring of an Application Site.

The use patterns for aldicarb (Table 3) suggest that application-site monitoring should be collected during the latter half of May through June, that monitoring be conducted in Kern or Kings County, and that monitoring should be associated with applications to cotton. Annually, application rates to cotton generally range from 0.5 to 2.0 pounds of active ingredient per acre. Therefore, monitoring should be conducted in Kern or Kings Counties from mid-May through June and should be related to applications at the highest rate. Aldicarb is extensively applied during this period so care should be taken so that nearby applications do not contaminate collected samples.

A three day monitoring period should be established with sampling times as follows: Application + 1 hour, followed by one 2-hour sample, one 4-hour sample, two 8-hour samples and two 24-hour samples. A minimum of four samplers should be positioned, one on each side of the field. A fifth sampler should be co-located at one position. Since aldicarb is extensively used in the area, background samples should collect enough volume (either 12 hours at 15 liters/minute, or a shorter period with a higher volume pump) to permit a reasonable minimum detection level. Ideally, samplers should be placed a minimum of 20 meters from the field. Field blank and field spike samples should be collected at the same environmental (temperature humidity, exposure to sunlight) and experimental (similar air flow rates) conditions as those occurring at the time of sampling.

We also request that you provide in the monitoring report: 1) An accurate record of the positions of the monitoring equipment with respect to the field, including the distance each monitor is positioned away from the edge of the field, 2) an accurate drawing of the monitoring site showing the precise location of the meteorological equipment, trees, buildings, and other obstacles, 3) meteorological data collected at a minimum of 15-minute intervals including wind speed and direction, humidity, and comments regarding degree of cloud cover, 4) the elevation of each sampling station with respect to the field, and 6) the orientation of the field with respect to North (identified as either true or magnetic North).